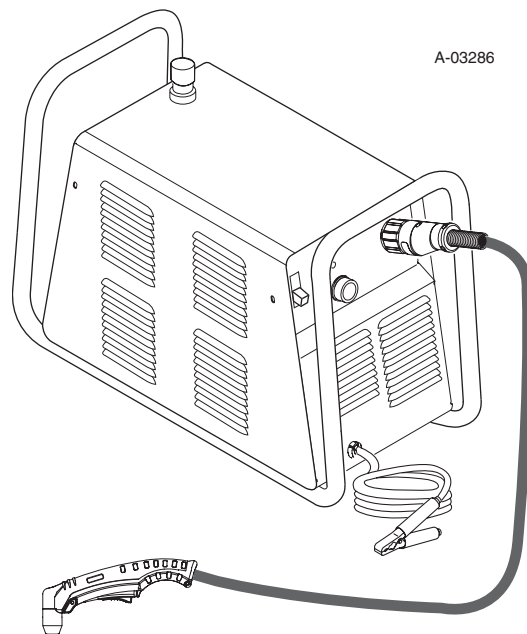




38

CUTMASTER™

PLASMA CUTTING SYSTEM



Service Manual

Rev. AA.01

Date: September 29, 2006

Manual # 0-2898

Operating Features:



30
AMP

DC

1
PHASE

120
V

**208-
230**
V



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Congratulations on your new Thermal Dynamics product. We are proud to have you as our customer and will strive to provide you with the best service and reliability in the industry. This product is backed by our extensive warranty and world-wide service network. To locate your nearest distributor or service agency call 1-800-426-1888, or visit us on the web at **www.thermal-dynamics.com**.

This Operating Manual has been designed to instruct you on the correct use and operation of your Thermal Dynamics product. Your satisfaction with this product and its safe operation is our ultimate concern. Therefore please take the time to read the entire manual, especially the Safety Precautions. They will help you to avoid potential hazards that may exist when working with this product.

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Thermal Dynamics is a Global Brand of manual and automation Plasma Cutting Products for Thermadyne Industries Inc.

We distinguish ourselves from our competition through market-leading, dependable products that have stood the test of time. We pride ourselves on technical innovation, competitive prices, excellent delivery, superior customer service and technical support, together with excellence in sales and marketing expertise.

Above all, we are committed to developing technologically advanced products to achieve a safer working environment within the welding industry.



WARNINGS

Read and understand this entire Manual and your employer's safety practices before installing, operating, or servicing the equipment.

While the information contained in this Manual represents the Manufacturer's best judgement, the Manufacturer assumes no liability for its use.

Plasma Cutting System

CutMaster™ 38 Power Supply
Model SL60 Air Plasma Cutting Torch

Operating Manual Number 0-2898

Published by:
Thermal Dynamics Corporation
82 Benning Street
West Lebanon, New Hampshire, USA 03784
(603) 298-5711

www.thermal-dynamics.com

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Printed in the United States of America

Publication Date: September 29, 2004

Record the following information for Warranty purposes:

Where Purchased: _____

Purchase Date: _____

Power Supply Serial #: _____

Torch Serial #: _____

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SECTION 1: GENERAL INFORMATION

1.01 Notes, Cautions and Warnings

Throughout this manual, notes, cautions, and warnings are used to highlight important information. These highlights are categorized as follows:

NOTE

An operation, procedure, or background information which requires additional emphasis or is helpful in efficient operation of the system.

CAUTION

A procedure which, if not properly followed, may cause damage to the equipment.



WARNING

A procedure which, if not properly followed, may cause injury to the operator or others in the operating area.

1.02 Important Safety Precautions



WARNINGS

OPERATION AND MAINTENANCE OF PLASMA ARC EQUIPMENT CAN BE DANGEROUS AND HAZARDOUS TO YOUR HEALTH.

Plasma arc cutting produces intense electric and magnetic emissions that may interfere with the proper function of cardiac pacemakers, hearing aids, or other electronic health equipment. Persons who work near plasma arc cutting applications should consult their medical health professional and the manufacturer of the health equipment to determine whether a hazard exists.

To prevent possible injury, read, understand and follow all warnings, safety precautions and instructions before using the equipment. Call 1-603-298-5711 or your local distributor if you have any questions.



GASES AND FUMES

Gases and fumes produced during the plasma cutting process can be dangerous and hazardous to your health.

- Keep all fumes and gases from the breathing area. Keep your head out of the welding fume plume.
- Use an air-supplied respirator if ventilation is not adequate to remove all fumes and gases.
- The kinds of fumes and gases from the plasma arc depend on the kind of metal being used, coatings on the metal, and the different processes. You must be very careful when cutting or welding any metals which may contain one or more of the following:

Antimony	Chromium	Mercury
Arsenic	Cobalt	Nickel
Barium	Copper	Selenium
Beryllium	Lead	Silver
Cadmium	Manganese	Vanadium

- Always read the Material Safety Data Sheets (MSDS) that should be supplied with the material you are using. These MSDSs will give you the information regarding the kind and amount of fumes and gases that may be dangerous to your health.
- For information on how to test for fumes and gases in your workplace, refer to item 1 in Subsection 1.03, Publications in this manual.
- Use special equipment, such as water or down draft cutting tables, to capture fumes and gases.
- Do not use the plasma torch in an area where combustible or explosive gases or materials are located.
- Phosgene, a toxic gas, is generated from the vapors of chlorinated solvents and cleansers. Remove all sources of these vapors.
- This product, when used for welding or cutting, produces fumes or gases which contain chemicals known to the State of California to cause birth defects and, in some cases, cancer. (California Health & Safety Code Sec. 25249.5 et seq.)



ELECTRIC SHOCK

Electric Shock can injure or kill. The plasma arc process uses and produces high voltage electrical energy. This electric energy can cause severe or fatal shock to the operator or others in the workplace.

- Never touch any parts that are electrically "live" or "hot."

- Wear dry gloves and clothing. Insulate yourself from the work piece or other parts of the welding circuit.
- Repair or replace all worn or damaged parts.
- Extra care must be taken when the workplace is moist or damp.
- Install and maintain equipment according to NEC code, refer to item 9 in Subsection 1.03, Publications.
- Disconnect power source before performing any service or repairs.
- Read and follow all the instructions in the Operating Manual.



FIRE AND EXPLOSION

Fire and explosion can be caused by hot slag, sparks, or the plasma arc.

- Be sure there is no combustible or flammable material in the workplace. Any material that cannot be removed must be protected.
- Ventilate all flammable or explosive vapors from the workplace.
- Do not cut or weld on containers that may have held combustibles.
- Provide a fire watch when working in an area where fire hazards may exist.
- Hydrogen gas may be formed and trapped under aluminum workpieces when they are cut underwater or while using a water table. **DO NOT** cut aluminum alloys underwater or on a water table unless the hydrogen gas can be eliminated or dissipated. Trapped hydrogen gas that is ignited will cause an explosion.



NOISE

Noise can cause permanent hearing loss. Plasma arc processes can cause noise levels to exceed safe limits. You must protect your ears from loud noise to prevent permanent loss of hearing.

- To protect your hearing from loud noise, wear protective ear plugs and/or ear muffs. Protect others in the workplace.
- Noise levels should be measured to be sure the decibels (sound) do not exceed safe levels.
- For information on how to test for noise, see item 1 in Subsection 1.03, Publications, in this manual.



PLASMA ARC RAYS

Plasma Arc Rays can injure your eyes and burn your skin. The plasma arc process produces very bright ultra violet and infra red light. These arc rays will damage your eyes and burn your skin if you are not properly protected.

- To protect your eyes, always wear a welding helmet or shield. Also always wear safety glasses with side shields, goggles or other protective eye wear.
- Wear welding gloves and suitable clothing to protect your skin from the arc rays and sparks.
- Keep helmet and safety glasses in good condition. Replace lenses when cracked, chipped or dirty.
- Protect others in the work area from the arc rays. Use protective booths, screens or shields.
- Use the shade of lens as suggested in the following per ANSI/ASC Z49.1:

Arc Current	Minimum Protective Shade No.	Suggested Shade No.
Less Than 300*	8	9
300 - 400*	9	12
400 - 800*	10	14

** These values apply where the actual arc is clearly seen. Experience has shown that lighter filters may be used when the arc is hidden by the work-piece.*

1.03 Publications

Refer to the following standards or their latest revisions for more information:

1. OSHA, SAFETY AND HEALTH STANDARDS, 29CFR 1910, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
2. ANSI Standard Z49.1, SAFETY IN WELDING AND CUTTING, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
3. NIOSH, SAFETY AND HEALTH IN ARC WELDING AND GAS WELDING AND CUTTING, obtainable from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
4. ANSI Standard Z87.1, SAFE PRACTICES FOR OCCUPATION AND EDUCATIONAL EYE AND FACE PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018
5. ANSI Standard Z41.1, STANDARD FOR MEN'S SAFETY-TOE FOOTWEAR, obtainable from the American National Standards Institute, 1430 Broadway, New York, NY 10018

6. ANSI Standard Z49.2, FIRE PREVENTION IN THE USE OF CUTTING AND WELDING PROCESSES, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018
7. AWS Standard A6.0, WELDING AND CUTTING CONTAINERS WHICH HAVE HELD COMBUSTIBLES, obtainable from American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
8. NFPA Standard 51, OXYGEN-FUEL GAS SYSTEMS FOR WELDING, CUTTING AND ALLIED PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
9. NFPA Standard 70, NATIONAL ELECTRICAL CODE, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
10. NFPA Standard 51B, CUTTING AND WELDING PROCESSES, obtainable from the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
11. CGA Pamphlet P-1, SAFE HANDLING OF COMPRESSED GASES IN CYLINDERS, obtainable from the Compressed Gas Association, 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202
12. CSA Standard W117.2, CODE FOR SAFETY IN WELDING AND CUTTING, obtainable from the Canadian Standards Association, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada M9W 1R3
13. NWSA booklet, WELDING SAFETY BIBLIOGRAPHY obtainable from the National Welding Supply Association, 1900 Arch Street, Philadelphia, PA 19103
14. American Welding Society Standard AWSF4.1, RECOMMENDED SAFE PRACTICES FOR THE PREPARATION FOR WELDING AND CUTTING OF CONTAINERS AND PIPING THAT HAVE HELD HAZARDOUS SUBSTANCES, obtainable from the American Welding Society, 550 N.W. LeJeune Rd, Miami, FL 33126
15. ANSI Standard Z88.2, PRACTICE FOR RESPIRATORY PROTECTION, obtainable from American National Standards Institute, 1430 Broadway, New York, NY 10018

1.04 Note, Attention et Avertissement

Dans ce manuel, les mots “note,” “attention,” et “avertissement” sont utilisés pour mettre en relief des informations à caractère important. Ces mises en relief sont classifiées comme suit :

NOTE

Toute opération, procédure ou renseignement général sur lequel il importe d'insister davantage ou qui contribue à l'efficacité de fonctionnement du système.

ATTENTION

Toute procédure pouvant résulter l'endommagement du matériel en cas de non-respect de la procédure en question.



AVERTISSEMENT

Toute procédure pouvant provoquer des blessures de l'opérateur ou des autres personnes se trouvant dans la zone de travail en cas de non-respect de la procédure en question.

1.05 Precautions De Securite Importantes



AVERTISSEMENTS

L'OPÉRATION ET LA MAINTENANCE DU MATÉRIEL DE SOUDAGE À L'ARC AU JET DE PLASMA PEUVENT PRÉSENTER DES RISQUES ET DES DANGERS DE SANTÉ.

Coupant à l'arc au jet de plasma produit de l'énergie électrique haute tension et des émissions magnétique qui peuvent interférer la fonction propre d'un “pacemaker” cardiaque, les appareils auditif, ou autre matériel de santé électronique. Ceux qui travail près d'une application à l'arc au jet de plasma devrait consulter leur membre professionnel de médication et le manufacturier de matériel de santé pour déterminer s'il existe des risques de santé.

Il faut communiquer aux opérateurs et au personnel TOUS les dangers possibles. Afin d'éviter les blessures possibles, lisez, comprenez et suivez tous les avertissements, toutes les précautions de sécurité et toutes les consignes avant d'utiliser le matériel. Composez le + 603-298-5711 ou votre distributeur local si vous avez des questions.



FUMÉE et GAZ

La fumée et les gaz produits par le procédé de jet de plasma peuvent présenter des risques et des dangers de santé.

- Eloignez toute fumée et gaz de votre zone de respiration. Gardez votre tête hors de la plume de fumée provenant du chalumeau.
- Utilisez un appareil respiratoire à alimentation en air si l'aération fournie ne permet pas d'éliminer la fumée et les gaz.
- Les sortes de gaz et de fumée provenant de l'arc de plasma dépendent du genre de métal utilisé, des revêtements se trouvant sur le métal et des différents procédés. Vous devez prendre soin lorsque vous coupez ou soudez tout métal pouvant contenir un ou plusieurs des éléments suivants:

antimoine	cadmium	mercure
argent	chrome	nickel
arsenic	cobalt	plomb
baryum	cuivre	sélénium
béryllium	manganèse	vanadium

- Lisez toujours les fiches de données sur la sécurité des matières (sigle américain "MSDS"); celles-ci devraient être fournies avec le matériel que vous utilisez. Les MSDS contiennent des renseignements quant à la quantité et la nature de la fumée et des gaz pouvant poser des dangers de santé.
- Pour des informations sur la manière de tester la fumée et les gaz de votre lieu de travail, consultez l'article 1 et les documents cités à la page 5.
- Utilisez un équipement spécial tel que des tables de coupe à débit d'eau ou à courant descendant pour capter la fumée et les gaz.
- N'utilisez pas le chalumeau au jet de plasma dans une zone où se trouvent des matières ou des gaz combustibles ou explosifs.
- Le phosgène, un gaz toxique, est généré par la fumée provenant des solvants et des produits de nettoyage chlorés. Éliminez toute source de telle fumée.
- Ce produit, dans le procédé de soudage et de coupe, produit de la fumée ou des gaz pouvant contenir des éléments reconnu dans L'état de la Californie, qui peuvent causer des défauts de naissance et le cancer. (La sécurité de santé en Californie et la code sécurité Sec. 25249.5 et seq.)



CHOC ELECTRIQUE

Les chocs électriques peuvent blesser ou même tuer. Le procédé au jet de plasma requiert et produit de l'énergie électrique haute tension. Cette énergie électrique peut produire des chocs graves, voire mortels, pour l'opérateur et les autres personnes sur le lieu de travail.

- Ne touchez jamais une pièce "sous tension" ou "vive"; portez des gants et des vêtements secs. Isolez-vous de la pièce de travail ou des autres parties du circuit de soudage.
- Réparez ou remplacez toute pièce usée ou endommagée.
- Prenez des soins particuliers lorsque la zone de travail est humide ou moite.
- Montez et maintenez le matériel conformément au Code électrique national des Etats-Unis. (Voir la page 5, article 9.)
- Débranchez l'alimentation électrique avant tout travail d'entretien ou de réparation.
- Lisez et respectez toutes les consignes du Manuel de consignes.



INCENDIE ET EXPLOSION

Les incendies et les explosions peuvent résulter des scories chaudes, des étincelles ou de l'arc de plasma. Le procédé à l'arc de plasma produit du métal, des étincelles, des scories chaudes pouvant mettre le feu aux matières combustibles ou provoquer l'explosion de fumées inflammables.

- Soyez certain qu'aucune matière combustible ou inflammable ne se trouve sur le lieu de travail. Protégez toute telle matière qu'il est impossible de retirer de la zone de travail.
- Procurez une bonne aération de toutes les fumées inflammables ou explosives.
- Ne coupez pas et ne soudez pas les conteneurs ayant pu renfermer des matières combustibles.
- Prévoyez une veille d'incendie lors de tout travail dans une zone présentant des dangers d'incendie.
- Le gas hydrogène peut se former ou s'accumuler sous les pièces de travail en aluminium lorsqu'elles sont coupées sous l'eau ou sur une table d'eau. NE PAS couper les alliages en aluminium sous l'eau ou sur une table d'eau à moins que le gas hydrogène peut s'échapper ou se dissiper. Le gas hydrogène accumulé explosera si enflammé.



RAYONS D'ARC DE PLASMA

Les rayons provenant de l'arc de plasma peuvent blesser vos yeux et brûler votre peau. Le procédé à l'arc de plasma produit une lumière infra-rouge et des rayons

ultra-violet très forts. Ces rayons d'arc nuiront à vos yeux et brûleront votre peau si vous ne vous protégez pas correctement.

- Pour protéger vos yeux, portez toujours un casque ou un écran de soudeur. Portez toujours des lunettes de sécurité munies de parois latérales ou des lunettes de protection ou une autre sorte de protection oculaire.
- Portez des gants de soudeur et un vêtement protecteur approprié pour protéger votre peau contre les étincelles et les rayons de l'arc.
- Maintenez votre casque et vos lunettes de protection en bon état. Remplacez toute lentille sale ou comportant fissure ou rognure.
- Protégez les autres personnes se trouvant sur la zone de travail contre les rayons de l'arc en fournissant des cabines ou des écrans de protection.
- Utilisez la nuance de lentille qui est suggérée dans le recommandation qui suivent ANSI/ASC Z49.1:

Courant Arc	Nuance Minimum Protective Numéro	Nuance Suggestée Numéro
Moins de 300*	8	9
300 - 400*	9	12
400 - 800*	10	14

** Ces valeurs s'appliquent ou l'arc actuel est observé clairement. L'expérience a démontré que les filtres moins foncés peuvent être utilisés quand l'arc est caché par moiceau de travail.*



BRUIT

Le bruit peut provoquer une perte permanente de l'ouïe. Les procédés de soudage à l'arc de plasma peuvent provoquer des niveaux sonores supérieurs aux limites normalement acceptables. Vous devez vous protéger les oreilles contre les bruits forts afin d'éviter une perte permanente de l'ouïe.

- Pour protéger votre ouïe contre les bruits forts, portez des tampons protecteurs et/ou des protections auriculaires. Protégez également les autres personnes se trouvant sur le lieu de travail.
- Il faut mesurer les niveaux sonores afin d'assurer que les décibels (le bruit) ne dépassent pas les niveaux sûrs.
- Pour des renseignements sur la manière de tester le bruit, consultez l'article 1, page 5.

1.06 Documents De Reference

Consultez les normes suivantes ou les révisions les plus récentes ayant été faites à celles-ci pour de plus amples renseignements :

1. OSHA, NORMES DE SÉCURITÉ DU TRAVAIL ET DE PROTECTION DE LA SANTÉ, 29CFR 1910, disponible auprès du Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
2. Norme ANSI Z49.1, LA SÉCURITÉ DES OPÉRATIONS DE COUPE ET DE SOUDAGE, disponible auprès de la Société Américaine de Soudage (American Welding Society), 550 N.W. LeJeune Rd., Miami, FL 33126
3. NIOSH, LA SÉCURITÉ ET LA SANTÉ LORS DES OPÉRATIONS DE COUPE ET DE SOUDAGE À L'ARC ET AU GAZ, disponible auprès du Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402
4. Norme ANSI Z87.1, PRATIQUES SURES POUR LA PROTECTION DES YEUX ET DU VISAGE AU TRAVAIL ET DANS LES ECOLES, disponible de l'Institut Américain des Normes Nationales (American National Standards Institute), 1430 Broadway, New York, NY 10018
5. Norme ANSI Z41.1, NORMES POUR LES CHAUSSURES PROTECTRICES, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018
6. Norme ANSI Z49.2, PRÉVENTION DES INCENDIES LORS DE L'EMPLOI DE PROCÉDÉS DE COUPE ET DE SOUDAGE, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018
7. Norme A6.0 de l'Association Américaine du Soudage (AWS), LE SOUDAGE ET LA COUPE DE CONTENEURS AYANT RENFERMÉ DES PRODUITS COMBUSTIBLES, disponible auprès de la American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126
8. Norme 51 de l'Association Américaine pour la Protection contre les Incendies (NFPA), LES SYSTEMES À GAZ AVEC ALIMENTATION EN OXYGENE POUR LE SOUDAGE, LA COUPE ET LES PROCÉDÉS ASSOCIÉS, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269

9. Norme 70 de la NFPA, CODE ELECTRIQUE NATIONAL, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
10. Norme 51B de la NFPA, LES PROCÉDÉS DE COUPE ET DE SOUDAGE, disponible auprès de la National Fire Protection Association, Batterymarch Park, Quincy, MA 02269
11. Brochure GCA P-1, LA MANIPULATION SANS RISQUE DES GAZ COMPRIMÉS EN CYLINDRES, disponible auprès de l'Association des Gaz Comprimés (Compressed Gas Association), 1235 Jefferson Davis Highway, Suite 501, Arlington, VA 22202
12. Norme CSA W117.2, CODE DE SÉCURITÉ POUR LE SOUDAGE ET LA COUPE, disponible auprès de l'Association des Normes Canadiennes, Standards Sales, 178 Rexdale Boulevard, Rexdale, Ontario, Canada, M9W 1R3
13. Livret NWSA, BIBLIOGRAPHIE SUR LA SÉCURITÉ DU SOUDAGE, disponible auprès de l'Association Nationale de Fournitures de Soudage (National Welding Supply Association), 1900 Arch Street, Philadelphia, PA 19103
14. Norme AWSF4.1 de l'Association Américaine de Soudage, RECOMMANDATIONS DE PRATIQUES SURES POUR LA PRÉPARATION À LA COUPE ET AU SOUDAGE DE CONTENEURS ET TUYAUX AYANT RENFERMÉ DES PRODUITS DANGEREUX, disponible auprès de la American Welding Society, 550 N.W. LeJeune Rd., Miami, FL 33126
15. Norme ANSI Z88.2, PRATIQUES DE PROTECTION RESPIRATOIRE, disponible auprès de l'American National Standards Institute, 1430 Broadway, New York, NY 10018

1.07 Declaration of Conformity

Manufacturer: Thermal Dynamics Corporation
Address: 82 Benning Street
West Lebanon, New Hampshire 03784
USA

The equipment described in this manual conforms to all applicable aspects and regulations of the 'Low Voltage Directive' (European Council Directive 73/23/EEC as amended by Council Directive 93/68/EEC) and to the National legislation for the enforcement of this Directive.

Serial numbers are unique with each individual piece of equipment and details description, parts used to manufacture a unit and date of manufacture.

National Standard and Technical Specifications

The product is designed and manufactured to a number of standards and technical requirements. Among them are:

- * CSA (Canadian Standards Association) standard C22.2 number 60 for Arc welding equipment.
- * UL (Underwriters Laboratory) rating 94VO flammability testing for all printed-circuit boards used.
- * ISO/IEC 60974-1 (BS 638-PT10) (EN 60 974-1) (EN50192) (EN50078) applicable to plasma cutting equipment and associated accessories.
- * Extensive product design verification is conducted at the manufacturing facility as part of the routine design and manufacturing process. This is to ensure the product is safe, when used according to instructions in this manual and related industry standards, and performs as specified. Rigorous testing is incorporated into the manufacturing process to ensure the manufactured product meets or exceeds all design specifications.

Thermal Dynamics has been manufacturing products for more than 30 years, and will continue to achieve excellence in our area of manufacture.

Manufacturers responsible representative: Giorgio Bassi
Managing Director
Thermal Dynamics Europe
Via rio Fabbiani 8A
40067 Rastignano (BO)
Italy

1.08 Statement of Warranty

LIMITED WARRANTY: Thermal Dynamics® Corporation (hereinafter "Thermal") warrants that its products will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within the time period applicable to the Thermal products as stated below, Thermal shall, upon notification thereof and substantiation that the product has been stored, installed, operated, and maintained in accordance with Thermal's specifications, instructions, recommendations and recognized standard industry practice, and not subject to misuse, repair, neglect, alteration, or accident, correct such defects by suitable repair or replacement, at Thermal's sole option, of any components or parts of the product determined by Thermal to be defective.

THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

LIMITATION OF LIABILITY: Thermal shall not under any circumstances be liable for special or consequential damages, such as, but not limited to, damage or loss of purchased or replacement goods, or claims of customers of distributor (hereinafter "Purchaser") for service interruption. The remedies of the Purchaser set forth herein are exclusive and the liability of Thermal with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, or use of any goods covered by or furnished by Thermal whether arising out of contract, negligence, strict tort, or under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the goods upon which such liability is based.

THIS WARRANTY BECOMES INVALID IF REPLACEMENT PARTS OR ACCESSORIES ARE USED WHICH MAY IMPAIR THE SAFETY OR PERFORMANCE OF ANY THERMAL PRODUCT.

THIS WARRANTY IS INVALID IF THE PRODUCT IS SOLD BY NON-AUTHORIZED PERSONS.

The limited warranty periods for Thermal products shall be as follows (with the exception of XL Plus Series, CutMaster Series, Cougar and DRAG-GUN): A maximum of three (3) years from date of sale to an authorized distributor and a maximum of two (2) years from date of sale by such distributor to the Purchaser, and with the further limitations on such two (2) year period (see chart below).

The limited warranty period for XL Plus Series and CutMaster Series shall be as follows: A maximum of four (4) years from date of sale to an authorized distributor and a maximum of three (3) years from date of sale by such distributor to the Purchaser, and with the further limitations on such three (3) year period (see chart below).

The limited warranty period for Cougar and DRAG-GUN shall be as follows: A maximum of two (2) years from date of sale to an authorized distributor and a maximum of one (1) year from date of sale by such distributor to the Purchaser, and with the further limitations on such two (2) year period (see chart below).

	Parts			
	XL Plus & CutMaster Series	Parts Cougar/Drag-Gun	Parts All Others	Labor
<u>PAK Units, Power Supplies</u>				
Main Power Magnetics	3 Years	1 Year	2 Years	1 Year
Original Main Power Rectifier	3 Years	1 Year	2 Years	1 Year
Control PC Board	3 Years	1 Year	2 Years	1 Year
All Other Circuits And Components Including, But Not Limited To, Starting Circuit, Contactors, Relays, Solenoids, Pumps, Power Switching Semi-Conductors	1 Year	1 Year	1 Year	1 Year
<u>Consoles, Control Equipment, Heat Exchanges, And Accessory Equipment</u>	1 Year		1 Year	1 Year
<u>Torch And Leads</u>				
Maximizer 300 Torch			1 Year	1 Year
SureLok Torches	1 Year		1 Year	1 Year
All Other Torches	180 Days	180 Days	180 Days	180 Days
<u>Repair/Replacement Parts</u>	90 Days	90 Days	90 Days	None

Warranty repairs or replacement claims under this limited warranty must be submitted by an authorized Thermal Dynamics® repair facility within thirty (30) days of the repair. No transportation costs of any kind will be paid under this warranty. Transportation charges to send products to an authorized warranty repair facility shall be the responsibility of the customer. All returned goods shall be at the customer's risk and expense. This warranty supersedes all previous Thermal warranties.

Effective November 15, 2001

SECTION 2: INTRODUCTION

2.01 Scope Of Manual

This manual provides service instructions for the Thermal Dynamics CutMaster 38 Plasma Cutting Power Supply. Information in this manual is intended for use by properly-trained service technicians familiar with this equipment.

For setup of this equipment, individual operating procedures, and basic troubleshooting, refer to Operating Manual (0-2888).

Read both the operating manual and the service manual thoroughly. A complete understanding of the capabilities and functions of this equipment will assure obtaining the performance for which it was designed.

2.02 General Service Philosophy

Several key points are essential to properly support the application and operation of this equipment.

A. Application

The equipment should satisfy the customer's requirements as supplied and as described in Section 3 of this manual. Be sure to confirm that the equipment is capable of the application desired.

B. Modifications

No physical or electrical modifications other than selection of standard options and Accessories are to be made to this equipment.

C. Customer/Operator Responsibilities

It is the customer/operator's responsibility to maintain the equipment and peripheral accessories provided by Thermal Dynamics in good operating order in accordance with the procedures outlined in the operating manual, and to protect the equipment from accidental or malicious damage.

D. Repair Restrictions

The electronics consists of a Printed Circuit Board (PCB) Assembly which must be carefully handled and must be replaced as a unit. No replacement of individual printed circuit components is allowed except as noted in this manual.

Printed Circuit Board Assemblies to be returned must be properly packaged in protective material and returned intact per normal procedures.

2.03 Service Responsibilities

The service technician should be familiar with the equipment and its capabilities and should be prepared to recommend arrangements of components which will provide the most efficient layout, utilizing the equipment to its best possible advantage.

Maintenance work should be accomplished in a timely manner. If problems are encountered, or the equipment does not function as specified, contact the Technical Services Department at West Lebanon, NH for assistance (1-603-298-5711).

SECTION 3: DESCRIPTION

3.01 Scope

The purpose of this section is:

- To familiarize the service technician with the capabilities and limitations of the equipment,
- To provide an overall understanding which will allow the technician, in turn, to properly train customer operating personnel.

3.02 Specifications/Design Features

CutMaster 38 Power Supply Specifications			
Input Power (See Note 1)	120 VAC (± 10%), Single-Phase, 50/60 Hz		
	208 - 230 VAC (± 10%), Single-Phase, 50/60 Hz		
Power Sensing	Automatic Voltage Selection. See Note 1.		
Input Power Cable	Cord with plug, for 120VAC, 20-Amp Single-Phase input power.		
Output Current	20-30 Amps, continuously variable		
Power Supply Gas Filtering Ability	Particulates to 20 Microns		
CutMaster 38 Power Supply Duty Cycle (Note 2)			
Ambient Temperature	104° F (40° C)		
Duty Cycle	35%	60%	n/a %
DC Voltage	78 vdc	89 vdc	n/a vdc
Current	30 Amps	22 Amps	n/a Amps
SL 60 Torch Gas Requirements			
Gas Type	Compressed Air		
Gas specifications	Clean, dry, oil-free (Note 3)		
Maximum Input Gas Pressure	125 psi / 8.6 bar		
Operating Gas Pressure	65 psi / 4.5 bar		
Gas Flow Requirements	300 scfh / 141.5 lpm		
Notes			
1. Power supply accepts 120-230 VAC input power. No manual switching is required.			
2. Duty Cycle is the percentage of time the system can be operated without overheating. Duty cycle is reduced if primary input voltage (AC) is low or the DC voltage is higher than shown in this chart.			
3. Air supply must be free of oil, moisture, and other contaminants. Excessive oil and moisture may cause double-arcing, rapid tip wear, or even complete torch failure. Contaminants may cause poor cutting performance and rapid electrode wear. Optional filters provide increased filtering capabilities.			

SECTION 4: TROUBLESHOOTING

4.01 Introduction

This section provides service diagnostics for the CutMaster 38 Power Supply, allowing the Technician to isolate any faulty subassemblies.

Under no circumstances are field repairs to be attempted on Printed Circuit Boards or other subassemblies of this unit. Evidence of unauthorized repairs will void the factory warranty.

NOTE

This manual covers the Power Supply only. Troubleshooting other parts of the system is covered in separate manuals for those products.

4.02 Periodic Inspection & Cleaning Procedures

This subsection describes inspection procedures which should be performed at periodic intervals as required.

A. Physical Inspection

Check that all wiring connections are secure.

B. Cleaning

Open the enclosure and use a vacuum cleaner to remove any accumulated dirt and dust. The unit should also be wiped clean. If necessary, solvents for cleaning electrical apparatus may be used.

Refer to Appendix for maintenance schedule and procedures. Clean or replace filters per Section 5.07.

4.03 System Design

The CutMaster 38 System is designed for hand cutting only.

4.04 Common Operating Problems



WARNINGS

Disconnect primary power at the source before disassembling the power supply, torch, or torch leads.

Frequently review the Important Safety Precautions in Section 1 of this manual. Be sure the operator is equipped with proper gloves, clothing, and eye and ear protection. Make sure no part of the operator's body comes into contact with the workpiece while the torch is activated.

Sparks from the cutting process can cause damage to coated, painted, and other surfaces such as glass, plastic and metal.

Handle torch leads with care and protect them from damage.

A. Piloting

Piloting is harder on parts life than actual cutting because the pilot arc is directed from the electrode to the tip rather than to a workpiece. Whenever possible, avoid excessive pilot arc time to improve parts life.

B. Torch Standoff

Improper standoff (the distance between the torch tip and workpiece) can adversely affect tip life as well as shield cup life. Standoff may also significantly affect the bevel angle. Reducing standoff generally results in a more square cut.

C. Edge Starting

For edge starts, hold the torch perpendicular to the workpiece with the front of the torch tip at the edge of the workpiece, not touching, at the point where the cut is to start. When starting at the edge of the plate, do not pause at the edge and force the arc to "reach" for the edge of the metal. Establish the cutting arc as quickly as possible.

D. Direction of Cut

The plasma gas stream swirls as it leaves the torch. The purpose of the swirl is to maintain a smooth column of gas. The swirl effect results in one side of a cut being more square than the other. Viewed along the direction of travel, the right side of the cut is more square than the left.

E. Dross

When dross is present on carbon steel, it is commonly referred to as either 'high speed, slow speed, or top dross'. Dross present on top of the plate is normally caused by too great a torch to plate distance. 'Top dross' is normally very easy to remove and can often be wiped off with a welding glove. 'Slow speed dross' is normally present on the bottom edge of the plate. It can vary from a light to heavy bead, but does not adhere tightly to the cut edge, and can be scraped off easily. 'High speed dross' usually forms a narrow bead along the bottom of the cut edge and is very difficult to remove. When cutting a troublesome steel, it is sometimes useful to reduce the cutting speed to produce 'slow speed dross'. Any resultant cleanup can be accomplished by scraping, not grinding.

F. Common Cutting Faults

1. Insufficient Penetration

- a. *Cutting speed too fast*
- b. *Torch tilted too much*
- c. *Metal too thick*
- d. *Worn torch parts*
- e. *Cutting current too low*
- f. *Non-Genuine Thermal Dynamics parts used*

2. Main Arc Extinguishes

- a. *Cutting speed too slow*
- b. *Torch standoff too high from workpiece*
- c. *Cutting current too high*
- d. *Work cable disconnected*
- e. *Worn torch parts*
- f. *Non-Genuine Thermal Dynamics parts used*

3. Excessive Dross Formation

- a. *Cutting speed too slow*
- b. *Torch standoff too high from workpiece*
- c. *Worn torch parts*
- d. *Improper cutting current*
- e. *Non-Genuine Thermal Dynamics parts used*

4. Short Torch Parts Life

- a. *Moisture in air source*
- b. *Exceeding system capability (material too thick)*
- c. *Excessive pilot arc time*
- d. *Gas pressure too low*
- e. *Improperly assembled torch*
- f. *Incorrect torch parts for the operation*
- g. *Non-Genuine Thermal Dynamics parts used*

4.05 Troubleshooting Guide - General Information



WARNING

There are extremely dangerous voltage and power levels present inside this unit. Do not attempt to diagnose or repair unless you have had training in power electronics measurement and troubleshooting techniques.

A. General Information

The CutMaster 38 Operating Manual describes basic troubleshooting and parts replacement procedures.

This Service Manual covers advanced troubleshooting, which requires power supply disassembly and live measurements. Advanced troubleshooting and repair of this unit should be undertaken only by those familiar with high voltage high power electronic equipment.

If major complex subassemblies are faulty, the faulty sub-assembly must be returned for repair.

NOTE

Follow all instructions as listed and complete each in the order presented.

The troubleshooting guide has subsections as follows:

Section 4.06 - Circuit Fault Isolation

Section 4.07 - Main Input and Internal Power Problems

Section 4.08 - Pilot Arc Problems

Section 4.09 - Main Arc Problems

Section 4.10 - Test Procedures

Subsection 4.10 includes specific test procedures, indications, and measurements. The subsection is referenced by the troubleshooting guide for the specific test to be performed.

B. How to Use the Troubleshooting Guide

The following information is a guide to help the Service Technician determine the most likely causes for various symptoms. This guide is set up as follows:

1. Perform operational check(s) on the equipment to isolate problem to possible circuit(s) per Subsection 4.06, Circuit Fault Isolation.
2. Determine symptom and isolate to defective assembly using the following format:

X. **Symptom (Bold Type)**

Any Special Instructions (Text Type)

1. *Cause (Italic Type)*
 - a. Check/Remedy (Text Type)
3. Locate your **symptom** in the appropriate Subsection.
4. Check the *causes* (easiest listed first) for the **symptom**.
5. Check the remedies listed for each cause. Remedies may have different specific information depending on the input voltage of the power supply.
6. Repair as needed being sure to verify that unit is fully operational after any repairs.

NOTES

*Many signals are transferred between Power Supply components on cables. If these cables become faulty they can cause various problems. **Do not** forget about these cables when troubleshooting.*

While troubleshooting visually inspect the internal components for signs of overheating, fractures and damage.

4.06 Circuit Fault Isolation

This section is to help isolate the defective circuit before troubleshooting, identify symptoms, and test the unit for proper operation. Follow the instructions as given to identify the possible symptom(s) and the defective circuit. After repairs are complete, run the following tests again to verify that the unit is fully operational.

A. Initial Setup Conditions

1. Connect gas supply to rear of Power Supply.
2. Turn on gas supply and adjust Power Supply Gas Regulator to 65 psi / 4.5 bar.
3. Set the Power Supply controls as follows:
 - ON/OFF  /  switch to OFF .
 - CURRENT (A) control knob to maximum
 - RUN / SET switch to SET

B. Main Input and Internal Power Tests

1. Connect main AC power to the unit.
2. Set the Power Supply ON/OFF switch to ON (up position) and check the following:
 - AC indicator  steady ON
 - TEMP Indicator  OFF
 - GAS Indicator  ON
 - Gas flows from torch
 - Fan operates
 - DC Indicator  is OFF
3. Turn RUN / SET switch to RUN
 - Gas should stop flowing
4. Turn ON / OFF switch to OFF, then back to ON. Check the following:
 - AC indicator ON
 - Temp indicator OFF
 - Gas indicator ON (gas does not flow)
 - Fan Operates
 - DC indicator OFF

This completes the Main Input and Internal Power Tests. If the unit functions as described then proceed to paragraph 'C'. If the unit does not function as described then note the symptom and proceed to Subsection 4.07, Main Input and Internal Power Problems.

C. Pilot Arc Test

1. Close the torch switch and check the following:
 - Gas flows briefly, then stops.
 - Gas flow re-starts; pilot arc starts. DC indicator is ON.

This completes the Pilot Arc Test. If the equipment operates as described then proceed to paragraph 'D'. If the equipment does not function as noted then note the symptom and proceed to Subsection 4.08, Pilot Arc Problems.

D. Main Arc Test

Activate the Torch to establish a pilot arc.

Bring the torch to approximately 3/16" (4.7 mm) from the workpiece to establish the main cutting arc, and note the following:

- Main cutting arc starts
- Cutting arc transfers to workpiece

This completes the Main Arc Test. If the equipment operates as described, proceed to Subsection 4.07. If problems still persist then contact Technical Services.

If the equipment does not function as described, note the symptom and proceed to Subsection 4.09, Main Arc Problems.

4.07 Main Input and Internal Power Problems

Locate your symptom below:

A. Main power line fuses blow as soon as main disconnect is closed

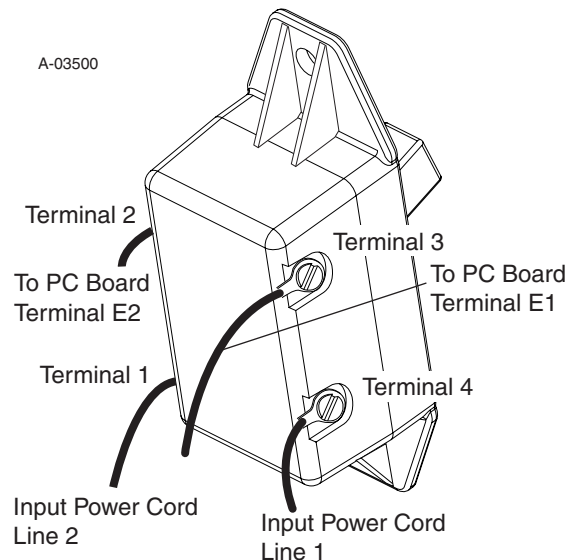
1. *Input power cable installed incorrectly or defective*
 - a. Refer to the Appendix pages for PC Board Wiring Layout. Check the input power cable for proper connections. Reconnect if necessary.
 - b. Test input power cable for continuity through all conductors. Replace cable if any conductor does not show continuity.

B. Main power line fuses blow immediately after the ON/OFF Switch is turned on.

1. *Faulty input diode bridge(s)*
 - a. Test input diode bridges per section 4.10-D; replace as needed.

C. Fan does not operate; AC indicator is OFF

1. *Front Panel ON/OFF switch in OFF (down) position*
 - a. Place switch to ON (up) position.
2. *Main power disconnect open (OFF)*
 - a. Close main power disconnect.
3. *Main power line fuses blown*
 - a. Replace main power line fuses.
4. *Input power cable disconnected or faulty*
 - a. Check power cable for proper connections to On/Off Switch.
 - b. Check power cable for continuity through all conductors.
5. *Wires from On/Off Switch to PC Board disconnected or faulty*
 - a. Check for proper connections.
 - b. Disconnect wires; check for continuity.
6. *Faulty ON/OFF switch*
 - a. Disconnect primary input power. Set the On/Off switch to ON (UP) position. Test for continuity between terminals 1 and 2, and between terminals 3 and 4. If there is no continuity, replace the ON/OFF Switch.



7. *Faulty Bias Transformer*

- a. Refer to PC Board Wiring Layout in the Appendix. Test for 380-410 vdc between TP-21 and TP-101 on PC Board. If voltage is not correct, replace the PC Board.

D. AC indicator flashing, TEMP indicator OFF (on system start-up); RUN / SET switch in RUN position

1. *Torch shield cup loose*
 - a. Shut power supply off. Tighten shield cup securely. Turn unit back on.
2. *Torch connection at power supply loose.*
 - a. Shut power supply off. Tighten torch leads male connector into female receptacle on power supply securely. Turn power supply back on.
3. *Faulty PIP switch or open PIP wires in torch leads*
 - a. Check torch PIP switch for continuity.
 - b. Check torch PIP leads for continuity.
4. *J3 wire connector disconnected from PC board.*
 - a. Check J3 connector; reconnect if necessary.

E. Gas flows continuously; AC indicator ON; TEMP indicator OFF; DC indicator OFF; GAS indicator ON

1. *RUN /SET Switch in SET (down) position*
 - a. Change to RUN (up) position.
2. *Faulty RUN / SET switch*
 - a. Disconnect primary input power. Disconnect wires from RUN / SET switch. Put switch in RUN (up) position. Check switch for open condition. If switch is shorted, replace switch.

F. AC indicator flashing (on start-up); TEMP indicator OFF; RUN / SET switch in RUN position; gas flows from torch

1. *Torch switch stuck ON or torch switch wires shorted*
 - a. Check indicator D22 on PC board. Indicator should be OFF unless torch switch is closed.
 - b. Check torch switch for proper operation.
 - c. Check torch switch for continuity.

G. AC indicator flashing (on start-up); TEMP indicator OFF, RUN / SET switch in RUN position,

1. *Torch tip, starter cartridge, or electrode missing or badly worn.*
 - a. Check torch parts; replace as needed.
2. *Dirty or defective starter cartridge*
 - a. Check starter cartridge; clean or replace as needed.

3. *Wire E8 not connected to PC Board terminal E8*

- a. Check connection; reconnect if necessary.

4. *PC board fault circuit defective*

- a. Replace PC board

H. AC indicator flashes; Temp indicator steady ON

1. *Fan wire harness disconnected from terminal J4 on PC board.*

- a. Check fan wire harness; reconnect if necessary

2. *Faulty fan or fan wire harness*

- a. Check fan and harness; replace as needed.

I. AC indicator flashes; TEMP indicator blinks slowly; RUN/SET switch in SET position

1. *Fan is blocked*

- a. Check fan blades; clear as needed.

2. *Faulty PC Board*

- a. Replace PC Board

J. No gas flow; AC indicator ON; TEMP indicator OFF; DC indicator OFF; Gas indicator ON; RUN/SET switch in SET position

1. *Inlet gas pressure too high (over 120 psi / 8.3 bar)*

- a. Set inlet gas pressure below 120 psi / 8.3 bar

2. *Faulty RUN/SET switch*

- a. Disconnect wires from RUN/SET switch. Test switch for continuity in SET position. If no continuity in SET position, replace switch.

3. *Faulty gas solenoid or solenoid wire harness.*

- a. Disconnect solenoid wire harness from terminal J1 on PC board. Test resistance in wire harness. Resistance should be 20 ohm $\pm$ 5 ohm. If resistance is not correct, replace solenoid assembly.

4. *Faulty PC board*

- a. Leave RUN/SET switch in SET position. Disconnect wire harness from terminal J1 on PC board. Test voltage across pins of terminal J1. Voltage should be 10-13vdc. If voltage is not correct, replace PC board.

K. AC indicator steady ON; TEMP indicator ON; RUN/SET switch in SET position

1. *PC board temperature sensor disconnected or faulty.*
 - a. Check wire harness connection at terminal J5 on PC board. Reconnect if necessary.
 - b. Disconnect PC board temperature sensor wire harness from J5 on PC board. Install a temporary jumper across the pins on PC board terminal J5. Check temperature indicator on Power Supply front panel. If TEMP indicator is OFF, replace PC board.

L. No gas flow; AC indicator ON; GAS indicator OFF; TEMP indicator OFF; DC indicator OFF; RUN/SET switch in SET position

1. *Gas supply not connected to unit*
 - a. Connect gas supply.
2. *Gas supply not turned on*
 - a. Turn gas supply on.
3. *Gas pressure too low*
 - a. Shut power supply off. Set gas pressure on the power supply gas regulator to 65 psi / 4.5 bar. turn power supply back on.
4. *Faulty PC board*
 - a. Disconnect pressure switch wire harness from terminal J9 on PC board. Test for continuity between sockets 2 and 3 on the wire harness connector. If gas pressure is above 65 psi / 4.5 bar and there is continuity between sockets 2 and 3, replace PC board.

4.08 Pilot Arc Problems

Locate your symptom below:

A. No pilot arc; Gas flows continuously; AC indicator ON; TEMP indicator OFF; GAS indicator ON; DC indicator OFF

1. *Shorted Torch*
 - a. Test torch and leads for continuity.
2. *Faulty PC Board*
 - a. Replace PC Board.

B. No arc or intermittent arc in torch; Gas flows; AC indicator ON; TEMP indicator OFF; GAS and DC indicators ON

1. *Gas pressure set incorrectly (too high)*
 - a. Set gas pressure on the Power Supply gas regulator to 65 psi / 4.5 bar.
2. *Oil/moisture in air lines*
 - a. Purge system. If problem is corrected, add filters in line with air source.
3. *Torch consumable parts incorrect or worn*
 - a. Refer to Operator's Manual.
4. *Starter cartridge missing from torch*
 - a. Shut off power. Remove shield cup from torch. Install starter cartridge if missing.
5. *Faulty leads*
 - a. Check continuity.
6. *Faulty torch*
 - a. Check continuity.
7. *Faulty PC Board*
 - a. Replace PC Board.

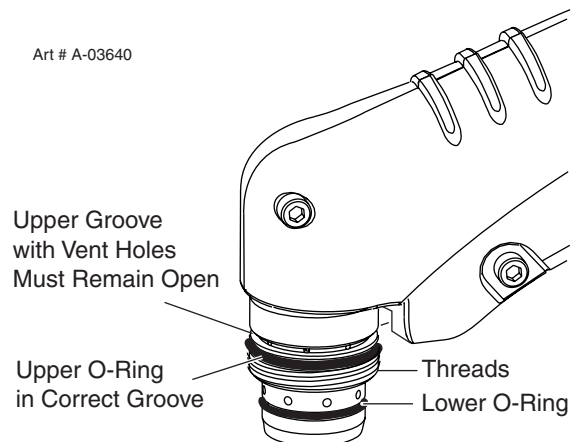
C. No pilot arc; GAS and DC indicators blink

1. *Gas pressure is too low.*
 - a. Set gas pressure to 65 psi / 4.5 bar.

D. No gas flow; AC and GAS indicators ON, TEMP and DC indicators OFF

1. *Upper O-ring on torch head is in wrong position.*
 - a. Remove shield cup from torch; check position of upper O-ring. Correct if necessary.

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4.09 Main Arc Problems

Locate your symptom below:

A. Main cutting arc will not start

1. *Work cable not connected.*
 - a. Connect work cable.
2. *Holding too high of a standoff*
 - a. Refer to Operating Manual for recommended standoff heights.
3. *Workpiece is painted or rusty.*
 - a. Clean workpiece.
4. *Starter cartridge missing from torch*
 - a. Shut off power. Remove shield cup from torch. Install starter cartridge if missing.
5. *Faulty Main Power PC Board*
 - a. Replace PC Board.

4.10 Test Procedures

The test procedures in this subsection are referenced in the troubleshooting section.

A. Safety Precautions

1. Significant DC Voltage exists after removal of input power. Allow two minutes for discharge time. Voltage measured on input capacitors must be zero before performing service on the power supply.
2. Do Not touch electrical components with any part of the human body when power is applied.
3. Keep away from any moving parts.
4. Hot surfaces can cause severe burns. Allow equipment to cool before servicing.
5. Electrostatic discharge can damage printed circuit board assemblies. Transport printed circuit boards in proper antistatic shielded packages. Use proper grounding techniques with wrist strap before handling printed circuit boards.
6. Misaligned plugs can cause printed circuit board damage. Be sure plugs are properly aligned and completely seated.
7. Excessive pressure can damage printed circuit board. Use only minimal pressure and gentle movement when disconnecting or connecting printed circuit board plugs.

B. Opening Power Supply Enclosure

The cover of the Power Supply must be removed to gain access to the input power connections.



WARNING

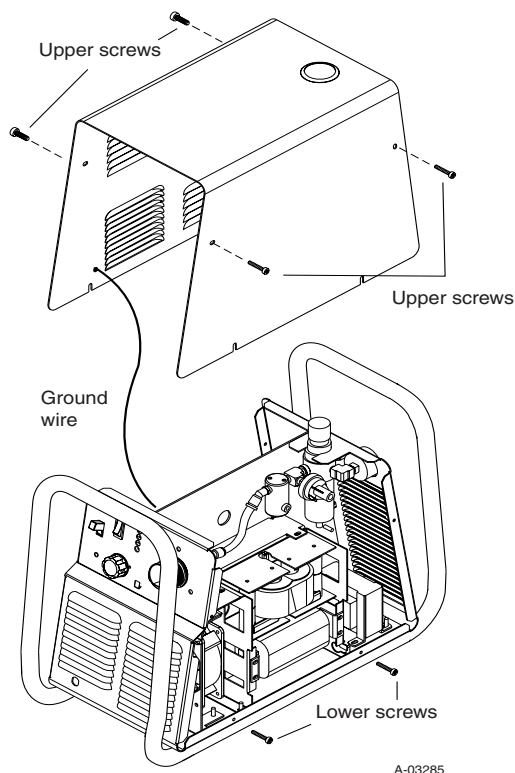
Disconnect primary power at the source before assembling or disassembling the Power Supply, torch parts, or torch and leads assemblies.

1. Remove the upper screws securing the cover to the main assembly.
2. Loosen, but do not remove, the lower screws.

NOTE

There is a ground wire attached from the cover to the main body of the unit.

3. Carefully lift the cover off the unit, and remove the nut securing the ground wire to the side panel.
4. Reinstall the cover by reversing the above steps.

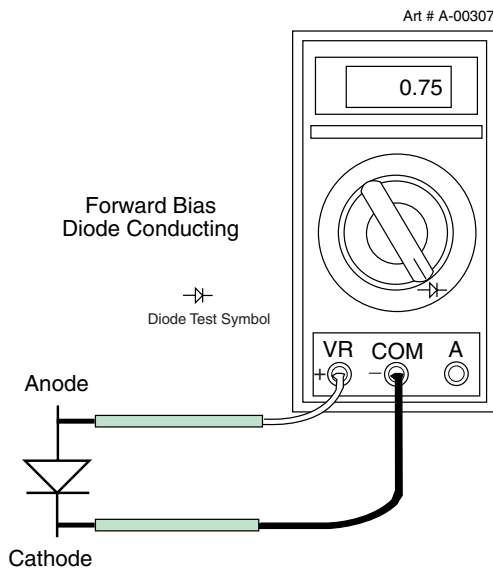


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C. Diode Testing Basics

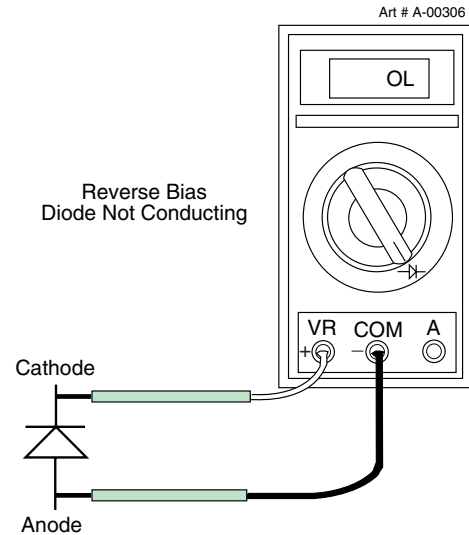
Testing of diode modules requires a digital volt/ohmmeter that has a diode test scale. Remember that even if the diode module checks good, it may still be bad. If in doubt, replace the diode module.

1. Locate the diode module to be tested.
2. Remove cables from mounting studs on diodes to isolate the module.
3. Set digital volt/ohmmeter to diode test scale.
4. Using the Figures for each test, check each diode in the module. Each diode must be checked in forward bias (plus to negative) and reverse bias (negative to plus) direction. A properly functioning diode will conduct in the forward bias direction and indicate between 0.3 to 0.9 volts.
5. Connect the volt/ohmmeter positive lead to the anode (+) of the diode and the negative lead to the cathode (-) of the diode for forward bias testing (refer to following figure). A properly functioning diode will conduct in the forward bias direction and indicate between 0.3 to 0.9 volts.



Testing Diode Forward Bias

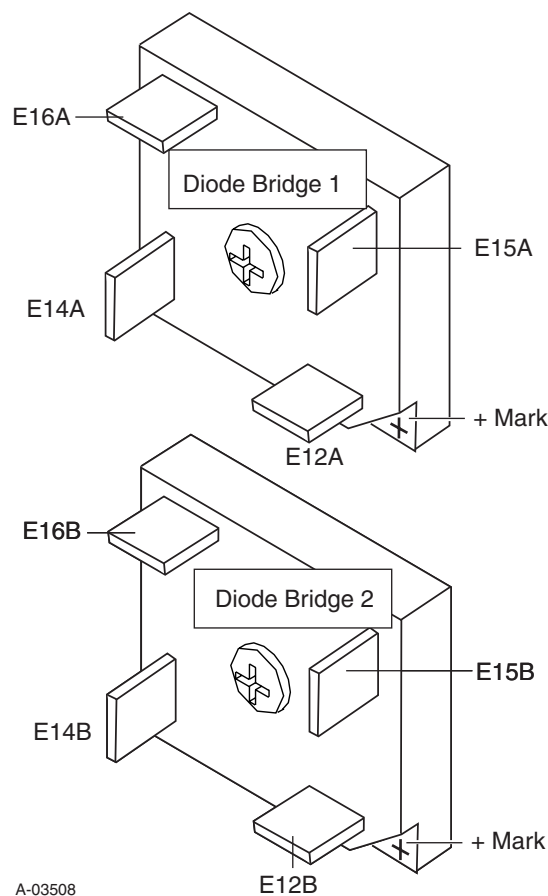
6. Reverse the meter leads across the diode for reverse bias testing (refer to following figure). A properly functioning diode will block in the reverse bias direction and depending on the meter function will indicate an open or "OL".



Testing Diode Reverse Bias

D. Diode Bridge Checks

Check for shorted Diode Bridges.



Disconnect primary input power. With an ohmmeter set on the diode range, make the following checks on both diode bridges:

CutMaster 38 Diode Bridge Check		
Meter (+)	Meter (-)	Indication
E16	E15	Diode Drop
E15	E16	Open
E16	E14	Diode Drop
E14	E16	Open
E14	E12	Diode Drop
E12	E14	Open
E15	E12	Diode Drop
E12	E15	Open

The meter should indicate a diode drop in one direction and an open in the other direction for each check.

SECTION 5: SERVICE

5.01 Introduction

This section describes parts replacement procedures and all repairs which may be performed on the CutMaster 38 Power Supply. Replacement instructions not included in this manual are supplied with the replacement kit.

Under no circumstances are field repairs to be attempted on Printed Circuits or other subassemblies of this unit. Evidence of unauthorized repairs may void the factory warranty.

5.02 Anti-Static Handling Procedures

A. General

Caution: PC Boards can be irreparably damaged by improper handling due to electrostatic discharge (ESD).

Replacement PC Boards are shipped in a protective enclosure to prevent damage from electrostatic discharge (ESD) during shipping. Included with each replacement board is a ground strap to prevent static damage during installation.



WARNINGS

Read and understand these instructions and the instructions on the grounding wrist strap package before opening the equipment enclosure or removing the replacement PC board from its protective enclosure.

Disconnect primary power to the system before disassembling the torch, torch leads, or power supply enclosure.

Do not operate the equipment or test equipment under power while wearing the grounding wrist strap.

Observe torquing requirements where given. Failure to torque properly will cause component damage.

B. Procedure

1. Open the wrist strap and unwrap the first two folds of the band. Wrap the adhesive side firmly around your wrist.
2. Unroll the rest of the band and peel the liner from the copper foil at the opposite end.
3. Attach the copper foil to a convenient and exposed electrical ground.
4. Connect the equipment primary cable ground to the same electrical ground as the wrist strap.
5. Open the equipment enclosure and remove the failed PC board.
6. Carefully open the ESD protective bag and remove the replacement PC Board.
7. Install the replacement PC Board in the equipment and make all necessary connections.
8. Place the failed PC Board in the ESD protective bag and seal for return shipping.
9. Replace the power supply cover.
10. Remove the grounding wrist strap from your wrist and from the electrical ground connection before reconnecting primary power to the equipment.

5.03 Parts Replacement - General Information

The parts replacement procedures described in this manual require that the Power Supply be opened and partially disassembled. The part to be replaced will determine the extent of disassembly.

Before removing any connection mark each wire with the connection designation. When reassembling make sure the wires go to the proper terminals.

Note the routing of wires and make sure the wires are put back in the same place when re-assembling the unit.

Refer to Section 6 for parts lists and overall detailed drawings.



WARNING

Disconnect the power supply from input power before opening or disassembling the power supply.

Before disassembling any part of the Power Supply first read the procedure for the part to be replaced, then proceed with the disassembly.

5.04 Major External Parts Replacement

Refer to Section 6 for Major External Replacement Parts and overall detailed drawing.

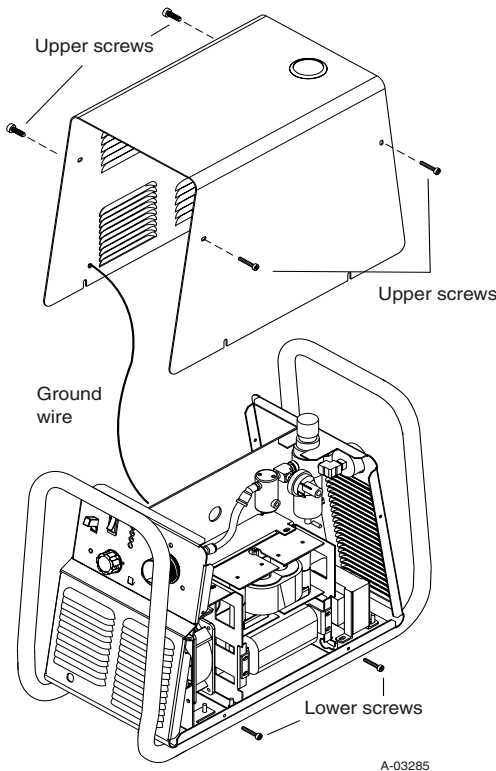


WARNING

Disconnect primary power from the source before opening or disassembling the power supply.

A. Cover Removal and Replacement

1. Remove the upper screws securing the cover to the unit then loosen the lower screws securing the cover to the base.



2. Carefully lift the cover up and away from the unit to gain access to the ground wire connection on the inside of the cover (left side near front).
3. Remove the nut and washer from the ground stud on the inside of the cover.
4. Install the replacement cover by reversing the above steps.

5.05 Front Panel Parts Replacement

Refer to Section 6 for Front Panel Replacement Parts and overall detailed drawing.



WARNING

Disconnect primary power from the source before opening or disassembling the power supply.

A. Output Control (A) Knob Replacement

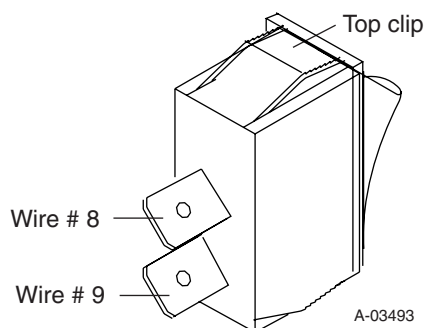
1. Turn the adjustment knob fully clockwise and note the location of the pointer on the knob.
2. Loosen the screw securing the Knob to the potentiometer shaft and remove the Knob.
3. Place the replacement Knob on the potentiometer shaft with the location of the pointer the same as noted in step 1.
4. Tighten the screw to secure the knob to the potentiometer shaft.

B. ON/OFF (I / O) Switch Replacement

1. Remove the cover per Subsection 5.04-A.
2. Disconnect wires E1 and E2 leading from the switch to terminals E1 and E2 on the PC Board.
3. Remove the hardware securing the switch to the Power Supply front panel.
4. Note the positions of the wires from the input power cable to the switch.
5. Disconnect the input power cable from the switch.
6. Connect the input power cable to the replacement switch, with the wires positioned as noted previously.
7. Transfer wires E1 and E2 to the replacement switch.
8. Attach the replacement Switch to the Power Supply front panel. Tighten the hardware securely.
9. Connect wires E1 and E2 to terminals E1 and E2 on the PC Board.
10. Reinstall the Power Supply cover.
11. Connect the Power Supply to primary input power. Test the Power Supply for proper operation.

C. Run/Set (/) Switch Replacement

1. Remove the Power Supply cover per Subsection 5.04-A.
2. Disconnect the Run/Set Switch wire harness from terminal J2 on the PC Board.
3. Squeeze together the clips on the rear of the Switch, then remove the switch and wire harness through the Front Panel.
4. Transfer the wiring harness to the replacement switch. Refer to the illustration for wire connections.



5. Pass the wiring harness through the front opening in the Power Supply. Press the switch into position in the Power Supply front panel firmly.
6. Connect the wiring harness to terminal J2 on the PC Board.
7. Reinstall the Power Supply cover.
8. Connect the Power Supply to primary input power. Test the Power Supply for proper operation.

5.06 Left Side Internal Parts Replacement

Refer to Section 6 Left Side Internal Replacement Parts.

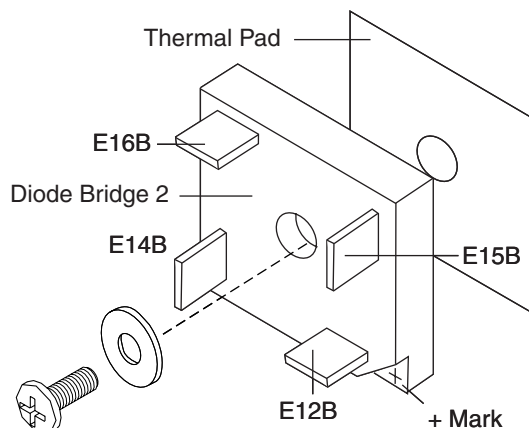
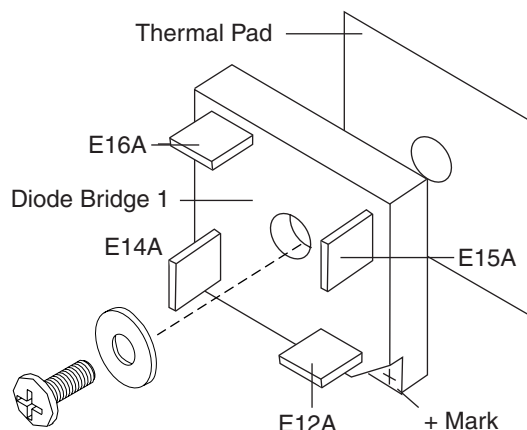


WARNING

Disconnect input power at the source and bleed down the system before attempting these procedures.

A. Diode Bridge Replacement

1. Remove the Power Supply cover per Subsection 5.04-A.
2. Label and remove the wires from the diode bridge to the PC Board. Refer to the illustration.
3. Remove RTV silicone over the screw head securing the diode bridge to the Fan Panel.
4. Remove hardware securing the diode bridge to the Fan Panel.
5. Remove the diode bridge.
6. Refer to the illustration. Position the diode bridge as shown. Note the location of the notched area marked (+) on the diode bridge. Position the replacement diode bridge on the thermal pad on the Fan Panel. Replace the thermal pad if it is damaged.



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7. Secure the diode bridge to the Fan Panel with the hardware removed previously. Torque the hardware to 15 in-lbs (1.7 Nm).
8. Apply RTV silicone over the securing hardware. Use care to avoid getting RTV on the electrical connectors.
9. Refer to the illustration. Connect wires from the PC Board to the diode bridge(s) being replaced.
10. Reinstall the Power Supply cover. Test the Power Supply for proper operation.

5.07 Rear Panel Parts Replacement

Refer to Section 6 for parts list and overall detailed drawing.



WARNING

Disconnect input power at the source and bleed down the system before attempting these procedures.

A. Pressure Gauge Replacement

1. Disconnect the gas input line from the Power Supply.
2. Remove the Power Supply cover per Subsection 5.04-A.
3. Disconnect the gas tube from the Pressure Switch Assembly Adapter Fitting. Hold a wrench or similar tool against the locking ring on the Fitting and pull the tube to release it.
4. Disconnect the Filter/Regulator Assembly as follows:
 - a. Pull the Regulator/Filter drain tube out of the hole in the base of the Power Supply.
 - b. Release the securing ring on the top of the Regulator/Filter Assembly.
 - c. Move the Regulator/Filter Assembly forward to disengage the inlet port and pressure gauge from the Power Supply rear panel.
5. Turn the Pressure Gauge to release it from the Regulator/Filter Assembly.
6. Apply thread sealant to the threads of the replacement Pressure Gauge.

NOTE

Do Not use Teflon tape as a thread sealer, as small particles of the tape may break off and block the small gas passages in the torch.

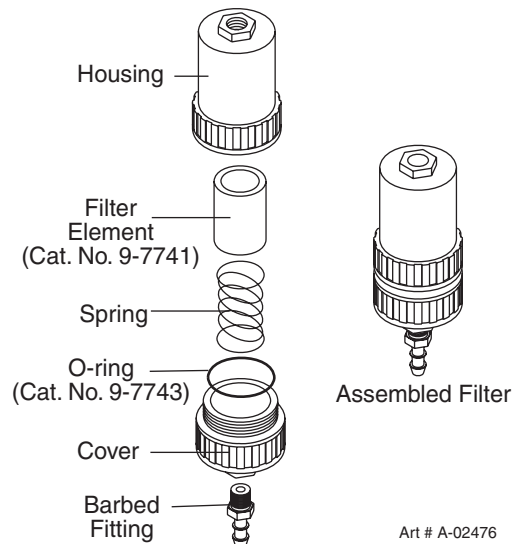
7. Thread the replacement Pressure Gauge into the Power Supply the Regulator/Filter Assembly. Tighten securely.
8. Position the Regulator/Filter Assembly in the bracket at the top of the Power Supply. Secure with the locking ring.
9. Connect the gas tube to the Pressure Switch Assembly Adapter Fitting. Push in the Fitting, and insert the gas tube. Release the Fitting. The fitting will automatically lock. Check for a secure connection.
10. Position the bottom end of the drain tube in the hole in the Power Supply base.
11. Reinstall the Power Supply cover. Connect the gas input line to the inlet port. Connect the Power Supply to primary input power.
12. Test the Power Supply for proper operation.

C. Optional Single-Stage Filter Element Replacement

NOTES

The Power Supply shuts down automatically when the Filter Element becomes completely saturated. The Filter Element can be removed from its housing, dried, and reused. Allow 24 hours for Element to dry.

1. Remove power from power supply.
2. Disconnect gas supply hose.



3. Turn the Cover counter-clockwise and remove it from the Filter Housing. The Filter Element is located inside the Housing.
4. Remove the Filter Element from the Housing and set Element aside to dry.
5. Wipe inside of housing clean, then insert the replacement Filter Element open side first, as shown.
6. Replace Housing on Cover.
7. Attach gas supply hose.

NOTE

If unit leaks between housing and cover, inspect the O-Ring for cuts or other damage.

5.08 Right Side Internal Parts Replacement

Refer to Section 6 for Right Side Internal Parts List and overall detailed drawing.

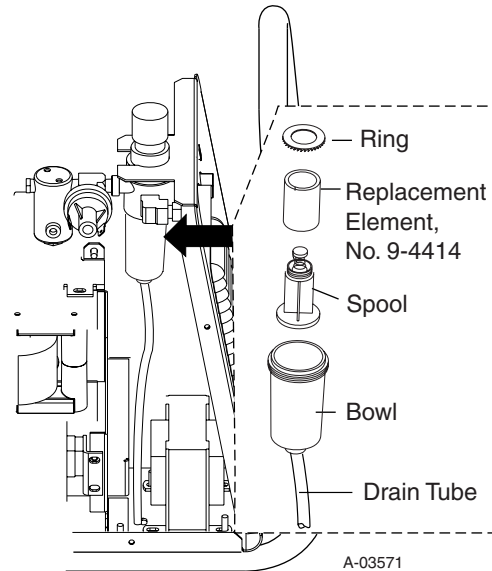


WARNING

Disconnect input power at the source and bleed down the system before attempting these procedures.

A. Standard Filter Element Replacement

1. Remove Power Supply Cover per Section 5.04A
2. Remove power from the power supply; turn off the gas supply.
3. Remove the drain tube from the bottom of the bowl on the Regulator/Filter Assembly.



4. Unscrew the bowl on the bottom of the Regulator/Filter Assembly. The filter element will be visible and still attached to the main body of the Regulator/Filter Assembly.
5. Grasp the filter element and unscrew it from the Regulator/Filter body. The filter element will come off with a spool and some additional pieces.
6. Note the correct assembly of the filter/spool then remove the filter from the spool. Either clean or replace the filter element.
7. The filter element and spool, with the baffle ring in place (teeth facing downward) can be screwed back into the Regulator body by compressing the spring on the spool. Tighten firmly by hand.
8. Reinstall the bowl. Connect the drain tube to the bowl.
9. Reinstall Power Supply cover per Section 5.04A.
10. Turn on the air supply. Test the Power Supply for proper operation.

B. Pressure Switch Replacement

1. Remove the cover per Subsection 5.04-A.
2. Label and disconnect the wires to the Pressure Switch.
3. Turn the Pressure Switch to remove it from the Regulator/Filter Assembly.
4. Apply thread sealant to the threads of the replacement Pressure Switch.

NOTE

Do Not use Teflon tape as a thread sealer as small particles of the tape may break off and block the small gas passages in the torch.

5. Thread the replacement Pressure Switch into place on the Regulator/Filter Assembly. Tighten securely.
6. Connect the wires from the Pressure Switch wire harness, with the wires positioned as marked previously.
7. Reinstall the Power Supply cover.
8. Reconnect the gas supply and primary input power. Test the Power Supply for proper operation.

SECTION 6: PARTS LISTS

6.01 Introduction

A. Parts List Breakdown

The parts lists provide a breakdown of all replaceable components. The parts lists are arranged as follows:

Section 6.03 Major External Replacement Parts

Section 6.04 Front Panel Replacement Parts

Section 6.05 Left Side Replacement Parts

Section 6.06 Right Side Replacement Parts

Section 6.07 Options and Accessories

NOTE

*Parts listed without item numbers are not shown,
but may be ordered by the catalog number shown.*

B. Returns

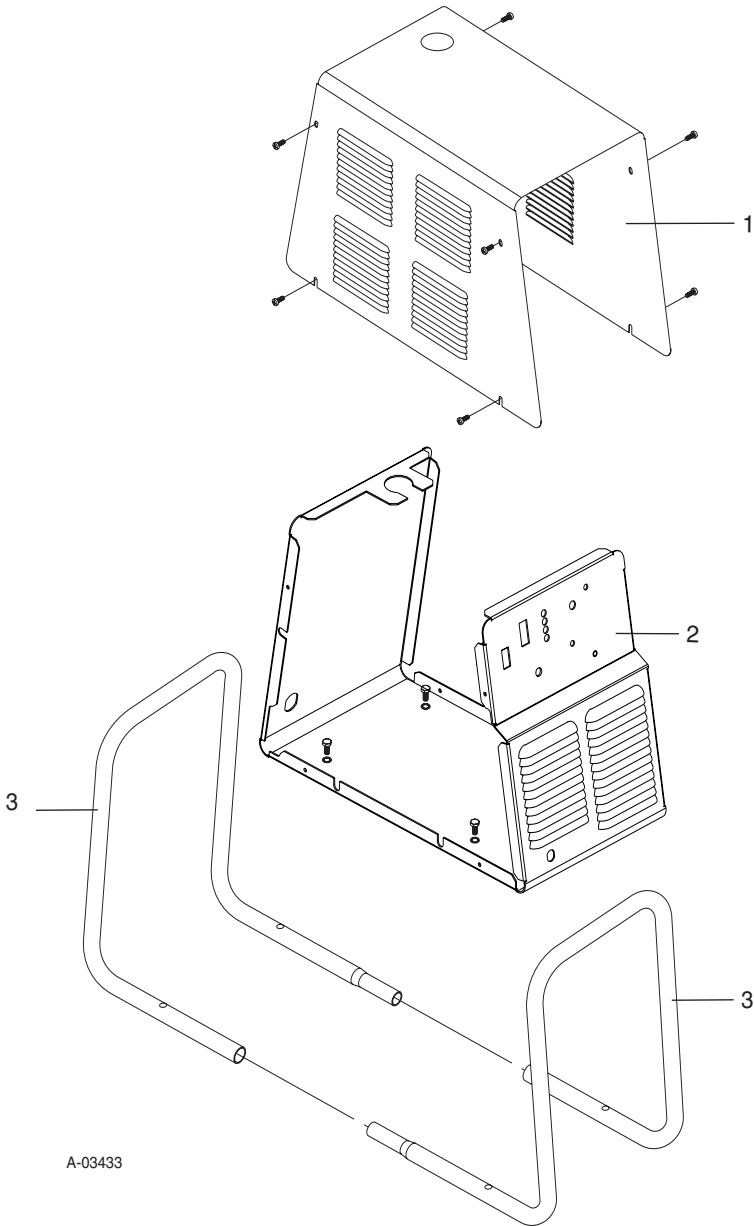
If a product must be returned for service, contact your distributor. Materials returned without proper authorization will not be accepted.

6.02 Ordering Information

Order replacement parts by catalog number and complete description of the part or assembly, as listed in the parts list for each type item. Also include the model and serial number of the torch. Address all inquiries to your authorized distributor.

6.03 Major External Replacement Parts

Item #	Qty	Description	Catalog #
1	1	Cover with labels	9-8631
2	1	Base Enclosure Assembly	9-8640
3	1	Tube, roll handle	9-8632

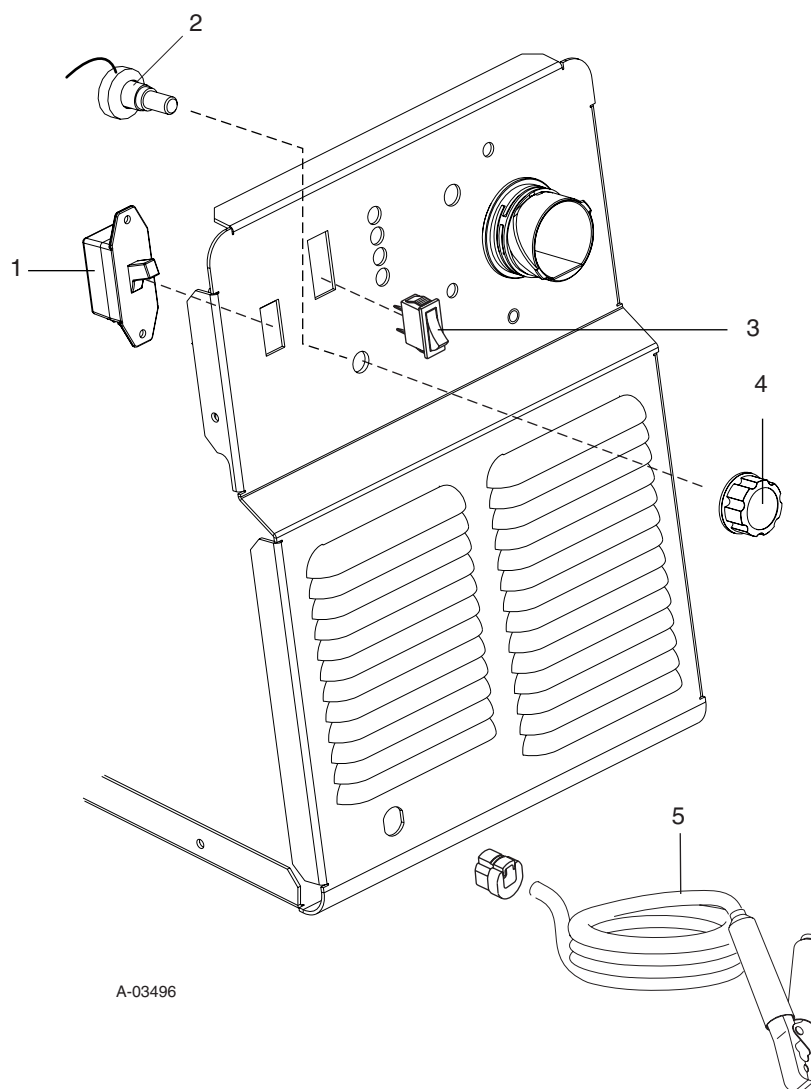


NOTE

Illustration may vary slightly from unit.

6.04 Front Panel Replacement Parts

Item#	Qty	Description	Ref.	Catalog #
1	1	On/Off Switch	SW1	8-4248
2	1	Output Current Control Potentiometer with wire harness		9-8629
3	1	Run/Set Switch	SW2	9-1042
4	1	Output Current Control Knob		9-8527
5	1	Work Cable with Clamp, 20 Ft / 6.1 m		9-8642



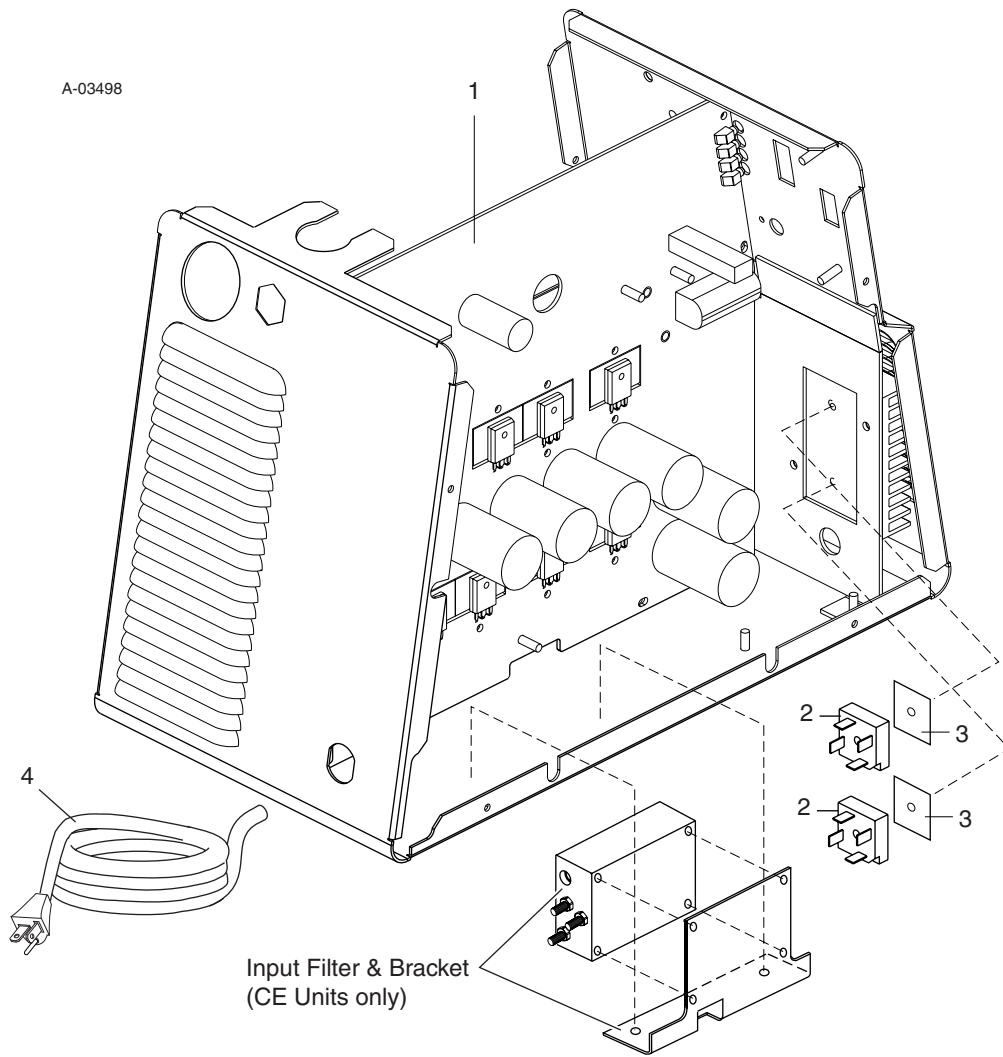
NOTE

Illustration may vary slightly from unit.

6.05 Left Side Replacement Parts

Item #	Qty	Description	Ref	Catalog #
1	1	PCB Assembly		9-8630
2	1	Diode Bridge	BR1, BR2	7-3345
3	1	Thermal Pad		9-4466
4	1	Input Power Cable with plug, for non-CE units through Unit Rev AE		9-8628
4	1	Input Power Cable with plug, for non-CE units at Unit Rev AF or later		9-8660
4	1	Input Power Cable for CE units Rev AA / AB		9-8661
4	1	Input Power Cable for CE units Rev AC or later		9-8671
4	1	Input Power Cable for (CE) Australian units		9-8663
Not Shown:				
	1	Power Cable Strain Relief, for non-CE units through Unit Rev AE		8-4263
	1	Power Cable Strain Relief, for non-CE units at Unit Rev AF or later		8-7072
	1	Power Cable Strain Relief, for CE units Rev AA / AB		8-7072
	1	Power Cable Strain Relief, for CE units Rev AC or later		9-8672
	1	Power Cable Strain Relief, for (CE) Australian units		8-4250

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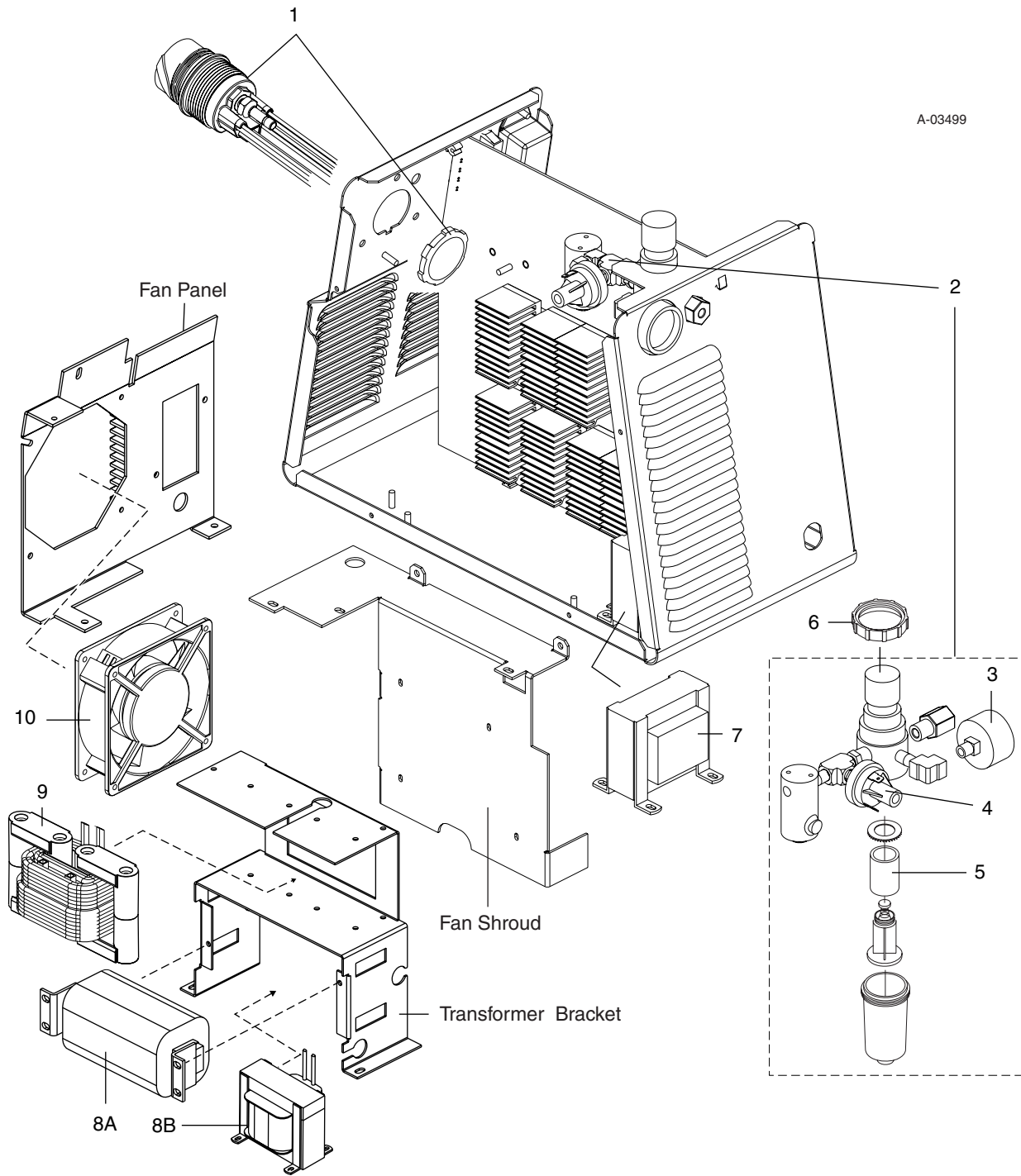


NOTE

Illustration may vary slightly from unit.

6.06 Right Side Replacement Parts

Item #	Qty	Description	Ref	Catalog #
1	1	Console ATC Assembly		9-8641
2	1	Regulator/Filter Assembly (includes Pressure Switch, Pressure Gauge, Solenoid)		9-8643
3	1	Pressure Gauge		9-1045
4	1	Pressure Switch	PS1	9-1044
5	1	Regulator/Filter Replacement Element		9-4414
6	1	Regulator Mounting Nut		9-5804
7	1	Assembly, Output Inductor	L1	9-8626
8A / 8B	1	PFC Choke (Type 8B assembly replaces Type 8A)	T1	9-8627
9	1	Main Transformer Assembly	T3	9-8625
10	1	Fan	M1	9-8639



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NOTE

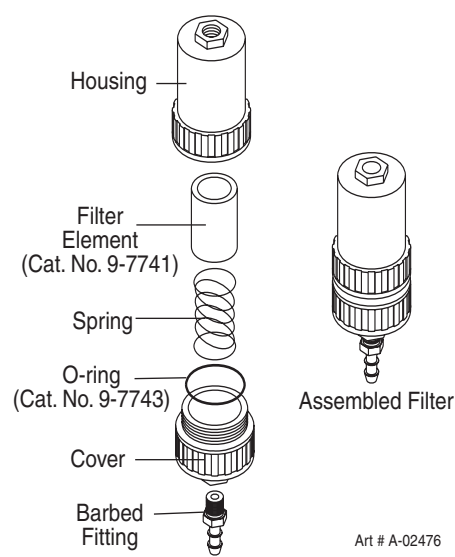
Illustration may vary slightly from unit.

6.07 Options and Accessories

Qty	Description	Catalog #
1	Single-Stage Filter Kit (Includes Filter And Hose)	7-7507
1	Replacement Filter Body	9-7740
1	Replacement Filter Element	9-7741
1	Replacement Filter Hose (Not Shown)	9-7742

Not shown:

1	Multi-Purpose Cart	7-8888
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Single-Stage Filter Kit

PATENT INFORMATION

The following parts are licensed under U.S. Patent No(s). 5120930 and 5132512

Catalog Number	Description
9-8235	Shield Cap, Drag 50-60A
9-8236	Shield Cap, Drag 70-100A
9-8237	Shield Cup, Body
9-8238	Shield Cap, Machine 50-60A
9-8239	Shield Cap, Machine 70-100A
9-8244	Shield Cap, Drag 40A
9-8245	Shield Cap, Machine 40A

APPENDIX 1: INPUT WIRING REQUIREMENTS

CutMaster 38 Input Power Requirements						
Input		Power Input	Current Input	Suggested Sizes (See Notes)		
Voltage	Freq.	(kVA)	(Amps)	Fuse (Amps)	Wire (AWG)	Wire (Canada)
(Volts)	(Hz)	1-Ph	1-Ph	1-Ph	1-Ph	1-Ph
120	50 / 60	3.6	29	35	12	12
208	50 / 60	3.5	16	20	12	12
230	50 / 60	3.4	14	20	12	12
Line Voltages with Suggested Circuit Protection and Wire Sizes Based on National Electric Code and Canadian Electric Code						

NOTES

Refer to Local and National Codes or local authority having jurisdiction for proper wiring requirements.

Cable size is de-rated based on the Duty Cycle of the equipment.

The suggested sizes are based on flexible power cable with power plug installations. For hard-wired installations refer to local or national codes.

Cable conductor temperature used is 167° F (75° C).

An energy limiting fuse UL Class RK-1 (examples: BUSS LPS/LPN-RK or Gould-Shawmut AZK-A6K) should be used to minimize damage to Plasma Cutting, Welding or power distribution equipment.

NEVER use replaceable element fuses like UL Class H, or "one-time" fuses like UL Class K5.

APPENDIX 2: MAIN POWER PC BOARD LAYOUT



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APPENDIX 4: MAINTENANCE SCHEDULE

This schedule applies to all types of *non-liquid cooled* plasma cutting systems. Some systems will not have all the parts listed and those checks need not be performed.

NOTE

The actual frequency of maintenance may need to be adjusted according to the operating environment.

Daily Operational Checks or Every Six Cutting Hours:

1. Check torch consumable parts, replace if damaged or worn.
2. Inspect torch for any cracks or exposed wires, replace if necessary.
3. Check plasma and secondary supply and pressure/flow.
4. Purge plasma gas line to remove any moisture build-up.
5. Inspect input power cable for damage or exposed wires, replace if necessary.

Weekly or Every 30 Cutting Hours:

1. Check fan for proper operation and adequate air flow.
2. Blow or vacuum dust and dirt *out* of the entire machine.

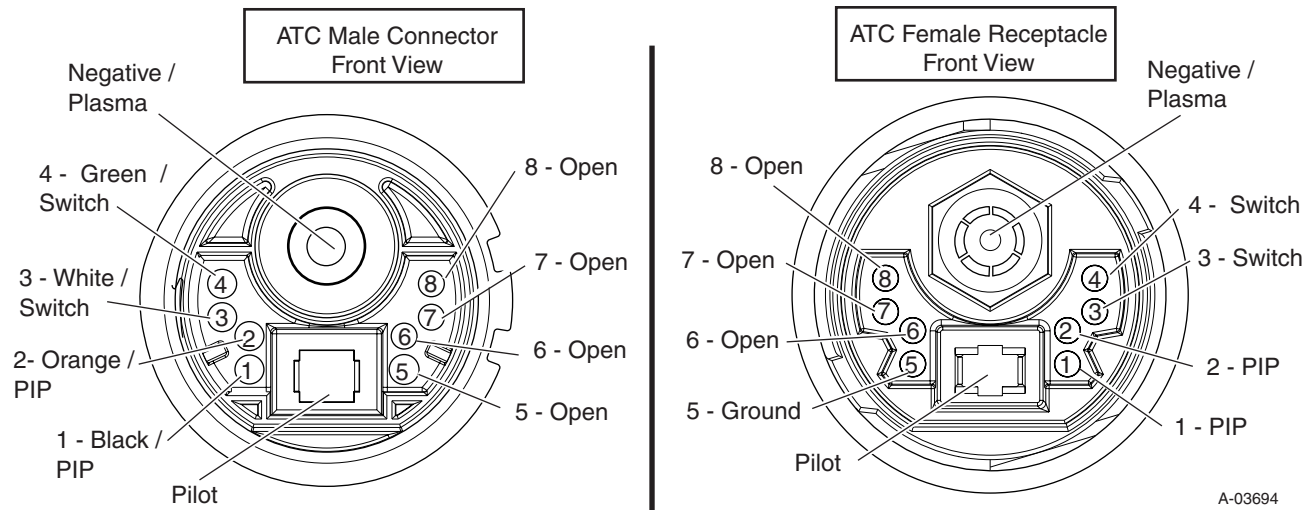
CAUTION

Do not blow air into the power supply during cleaning. Blowing air into the unit can cause metal particles to interfere with sensitive electrical components and cause damage to the unit.

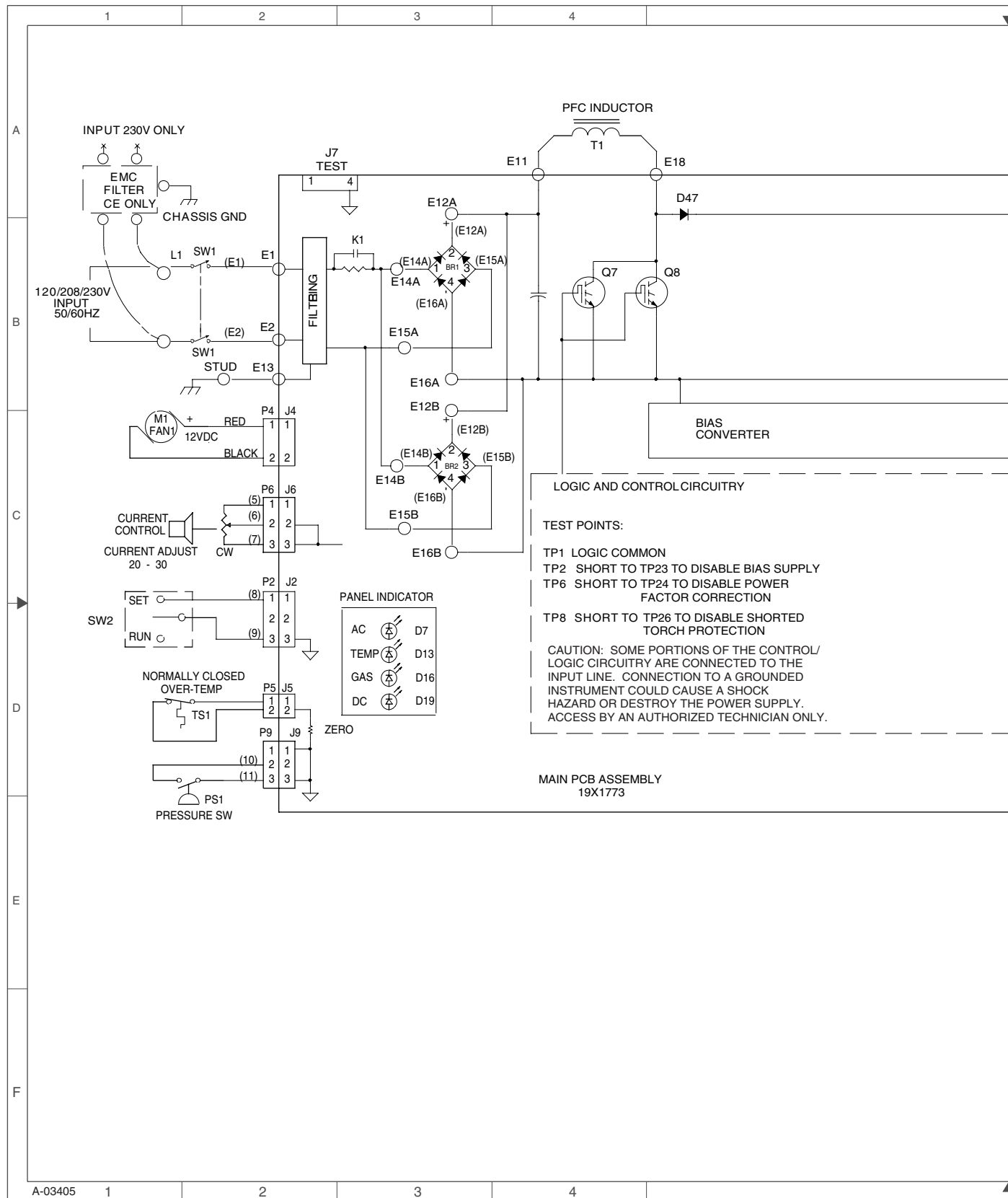
Six Months or Every 720 Cutting Hours:

1. Check the in-line air filter(s), clean or replace as required
2. Check cables and hoses for leaks or cracks, replace if necessary.
3. Check all contactor points for severe arcing or pits, replace if necessary.

APPENDIX 5: TORCH CONNECTOR DIAGRAM



APPENDIX 6: SYSTEM SCHEMATIC



APPENDIX 7: PUBLICATION HISTORY

Cover Date	Rev	Details
1/31/2003	--	Manual Released.
4/8/2003	--	Revised; updated trouble-shooting per Tech Service, updated system schematic to Rev. AC, added CE input filter.
7/3/2003	--	Updated power cord per ECO 100487, added pin-out diagram for torch connector.
4/12/2006	AA	Added input power cords & strain reliefs, per ECOs 101877 & B049.
9/29/06	AA.01	Added patent information at the end of section 6 per ECO-B193. Updated rear cover adding contact information. Applied next rev level format.



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